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(71) Applicant: International Business Machines Corporation
Armonk, N.Y. 10504(US)

(72) Inventor: Rhodes, John Huntley, Jr.
1225 South Terry Street
Longmount Colorado 80501(US)

(74) Representative: Hawkins, Anthony George Frederick
IBM United Kingdom Patent Operations Hursley Park
Winchester Hants S021 2JN(GB)

(54) Original document transport mechanism for an electrophotographic copier.

(57) A transport mechanism for original documents in an electrophotographic copier comprises a belt system (28) for feeding documents from an entry tray (24) round a closed path, including imaging station, platen (18) and gate (34), and above the imaging station, a storage station, controlled by a gate (36). A diverter (38) is movable to direct a sheet either round the path or into an exit tray (40), and a diverter (44) directs a sheet round the path or back to the entry tray. By suitably controlling the gates and diverters it is possible to store a sheet after imaging whilst a subsequent sheet is fed to the imaging station; if a copy jam is detected, the sheet can be again fed to the imaging station from the storage station. Another function is to feed back duplex originals to the entry tray in reversed orientation with respect to their original orientation.

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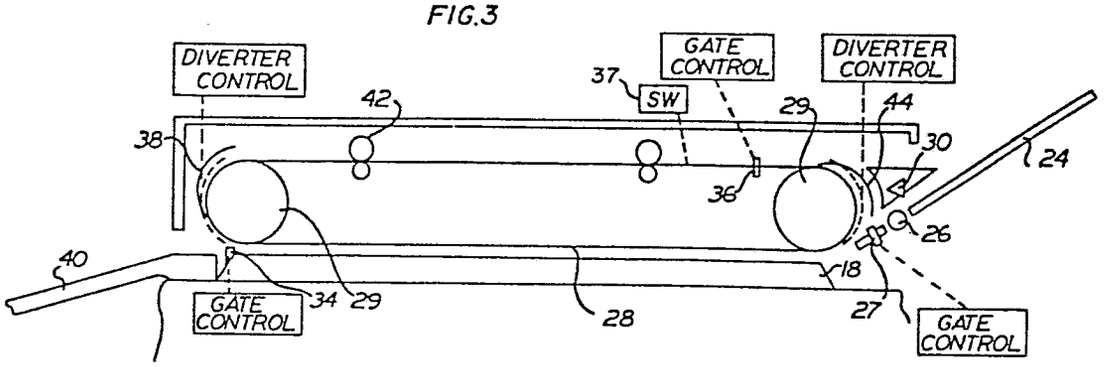
FIG.3


DIVERTER CONTROL
GATE CONTROL
DIVERTER CONTROL
37
SW
42
29
44
38
30
24
36
26
40
18
GATE CONTROL
34
29
28
27
GATE CONTROL

ORIGINAL DOCUMENT TRANSPORT MECHANISM FOR AN ELECTROPHOTOGRAPHIC COPIER

The present invention relates to apparatus for transporting original documents for electrophotographic copiers.

Developments in such copiers have been directed to increasing the copying rates and versatility of these machines. There are, for example, machines which will produce, if required, duplex (two sided) copies of simplex (one sided) or duplex original documents. Multiple copies of sets of original documents can be collated automatically into multiple copy sets, when required. This increasing versatility, however, can raise problems for operators, particularly when a fault occurs during a reproduction run. In particular, when an operator clearable fault, such as a copy paper jam, occurs, the operator must be able to allow the machine to continue to make copies starting with the replacement of the leading copy in the machine which was not produced due to the fault. Obviously, as the machine functions become more complex such fault recovery and re-starting become more complex.

In order to simplify use of machines by operators, semi-automatic and automatic original document handlers have been used, examples of such devices can be seen in U.S. Patent Specification Nos. 3,747,918 and 3,790,158. In addition, it has been proposed, as can be seen from U.S. Patent Specification No. 3,588,472, to incorporate control logic and sensors in a machine to track copying in the machine so that, if a copy paper jam occurs, the number of successfully complete copies is known.

Systems for re-circulating original documents back to an entry tray are also known. In U.S. Patent Specification No. 3,790,158, for example, there is shown an arrangement in which an original document that has been copied is returned to a document supply tray and stacked on a movable bail which separates the copied originals from those yet to be copied. One particularly versatile arrangement employing semi-automatic document feed is shown in U.S. Patent Specification No. 4,090,787. This describes both simplex and duplex operations as well as the performance of other control functions. The prior art, as far as it is known, however, does not show a simple system of document feed which allows retention of an original document after copying for simple re-feeding either for copy paper jam recovery or other operations such as duplex original copying.

According to the invention, there is provided an original document transport mechanism for an electrophotographic copier comprising means for transporting original documents round a closed path through an imaging station which includes gating means movable into the path to locate a document in position for imaging, an entry tray arranged to receive documents to be transported and to direct them into the path, a first diverter device movable between a position adjacent the path to maintain documents in the path and a position intercepting the path to divert documents therefrom towards an exit tray, characterised in that said path passes through a storage station into which documents in the path pass in face-inverted orientation with respect to their orientation at the imaging station, said storage station including gating means movable into the path to locate a document therein at a fixed storage position.

In order that the invention can be fully understood, it will now be described, by way of example, with reference to the accompanying drawings, in which:-

Fig. 1 is a simplified schematic and block diagram representation of a copying system including a document handler embodying the invention;

Fig. 2 is a flow diagram that illustrates successive functional states that can occur under different conditions of operation;

Fig. 3 is a side sectional view showing in greater detail the document handler employed in the system of Fig. 1; and

Fig. 4 is a side sectional view showing an alternative form of document handler that may be employed in the copying system of Fig. 1.

Fig. 1 shows an electrophotographic copying system in which an original document moving in one path may be used to generate a selectable number (one or more) of copies moving in a separate path. A semiautomatic or automatic document feeding system may be employed for the originals, in that the documents to be copied may involve limited (semiautomatic) or no (automatic) operator handling once a stack of masters is ready for input, however, for simplicity, a semiautomatic document feed (SADF) has been shown. A duplexing feature is incorporated in the transport mechanism for the copy document, in order that they may be stored after an image has been copied on one side and returned to receive an image on the other side.

In the copying system of Fig. 1, the principal operative units comprise a master document transport system 10, an imaging system 12, a copy document transport system 14, and control circuits 16. The imaging system 12 may incorporate any of a variety of conventional light sources, scanners and optics for transferring the image of a master document that is positioned within the master document transport system 12 on to a receiving drum 20. In the master document transport system 10, original documents are transferred to and past a fixed position which is herein termed the imaging station and defined by a platen or document glass 18. Details of the optical path and the light scanning mechanism have been omitted for simplicity, as have the successive stations utilized in the electrophotogrpahic reproduction process, such as the charging station, developer, and fuser. The interface between the drum 20 and a copy document moving along the copy document transport system 14 is herein broadly referred to as the image transfer station.

In the master document transport system 10 (referring now to both Figs. 1 and 3), original documents to be reproduced are placed by the operator on an entry tray 24 and held by an entry roller 26 against an entry gate 27. The entry gate 27 is disposed adjacent a transport mechanism which forms a loop or recirculating path that is adjacent, in part, to the image station. Although rollers, guides and other conventional mechanisms may be used, as will be understood by those skilled in the art, an endless transport belt 28 wrapped about a pair of drive rollers 29 provides a suitable example of a readily mechanized system. The transport mechanism

defines both a first (lower in Fig. 1) run which is adjacent the imaging station at the document glass 18 and a second (upper in Fig. 1) run, immediately above, which moves the document in the opposite direction and also defines a storage station. These runs are referred to as "lower" and "upper" hereafter for ease of visualization, and because of the attitude and location of the low profile semiautomatic feeder mechanism of Fig. 1. In other systems the physical disposition may be entirely different, as dictated by the overall configuration. A pre-entry sensor 30 positioned adjacent the entry roller 26 detects the presence of a document and provides an actuating signal utilized in the control circuits 16 to actuate the entry gate 27 at the proper time, in a fashion widely used in existing systems.

At the downstream edge of the imaging station along the lower run is mounted an exit gate 34, for positioning of the original document at the imaging station, while along the upper run, at the downstream end of the storage station, is similarly mounted a storage gate 36. A jam detection switch 37 (Fig. 3 only) is mounted along the upper run to detect the presence of a document at the storage station. Each gate 34, 36 is opened when it is desired to move the document with the transport system. An exit diverter 38 positioned between the lower and upper runs can be moved selectively into position to intercept a document exiting from the lower run. The document would otherwise be deposited on an exit tray 40 downstream from the lower run, but is instead inverted and turned upwardly through an approximately 180° arc onto the upper run, where guide rollers 42 aid in the paper drive toward the storage gate 36. Similarly, adjacent the downstream end of the upper run at the associated drive roller 29, an entry

diverter 44 is positioned selectively to intercept the document from the upper run and return it, again reversed in direction and inverted in position, to the lower run. If the entry diverter 44 is not operated so as to be in position to intercept the document, the master follows a substantially straight line path from the upper run back to the entry tray 24, in which position it is inverted from its original position, and with its former trailing edge now being the leading edge, so that it is now in a juxtaposition which permits reentry for making a duplex copy. However, it may be preferred to utilize a separate tray for collecting duplex original documents, as is described hereinafter in conjunction with Fig. 4.

In the copy document transport system 14, referring again only to Fig. 1, apart from a transport belt 50 and drive rollers 52 downstream of the image transfer station, most of the details of the flow path for the copy documents, such as gates, diverters, guides and drive rollers have been omitted for simplicity. A number of document sensor switches, however, are incorporated in various points along the paper path, which commences at a paper bin 54 and may be directed to a duplex storage bin 56, but in any event terminates at an exit pocket 58 (although a collator system may be employed if desired).

The paper sensor switches may comprise photoelectric, pneumatic or electromechanical devices for sensing the passage of a copy document. These sensors (designated SW) are positioned along all of the possible flow paths for the copy documents, so that a paper jam at any location may be ascertained. Within a predetermined time interval following the actuation of some prior mechanism, a

sensor should detect the passage of a document past its location, and the failure to do so gives rise to the indication of a paper jam. Therefore a paper feed switch 60 is positioned downstream of the paper bin 54 and along the path toward the image transfer station. A pretransfer switch 62 is positioned on the main path between lines 54 and 56 and the drum, a drum image count switch 63 is positioned at the image transfer station and a post-transfer switch 64 is positioned downstream of the image transfer station. The copy document may thereafter be diverted into either of two paths, one leading to the exit pocket 58 and the other leading to the duplex storage bin 56. In the former path, there are disposed both an exit diverter switch 66 at a midstream location, and an exit pocket switch 68 in the exit pocket 58 region itself, the latter switch determining final and satisfactory delivery of the copy document. In the alternate path leading to the duplex storage bin 56 is disposed a duplex entry switch 70, for detecting movement of copy documents into the duplex storage bin 56. Documents fed out of the duplex storage bin 56 are diverted back toward the image transfer station, and are detected before joining with the path from the paper bin 54 by a duplex exit switch 72. Consequently, even though a copy document may traverse the entire route from paper bin 54 past the image transfer station, into and out of the duplex storage bin 56, again past the image transfer station and then out to the exit pocket 56, its presence or absence at each critical juncture in the path will be detected by an appropriate switch so that a paper jam can be detected - the probable location can also be indicated to the operator if desired.

In the control circuits 16, jam detection circuits 80 each receive signals from the various switches 60-72 respectively, and may also receive signals from the various gates, diverters and

actuators that are used in the copy document flow path and have not been shown in detail. In each instance, the jam detection circuits 80 operate in well understood fashion, to determine whether the copy document has reached the next appropriate position after some prior action has been performed or set of logical conditions has been met. For example, the paper feed switch 60 should detect the passage of a copy document within a predetermined time interval after actuation of the feed mechanism associated with the paper bin 54. The pretransfer switch 62 should detect the passage of a copy document within a predetermined time interval after actuation of either the paper feed switch 60 or the duplex exit switch 72. On the other hand, because a control gate (not shown) may be positioned before the image transfer station, the post-transfer switch 64 is conditioned to provide an indication of document passage within a predetermined time after opening of the gate, rather than the pretransfer switch 62. These functions are provided in well understood fashion by time delay relays, one-shot multivibrators or clock operated timing circuits, and have therefore not been depicted in detail. Similarly, the jam detection circuits 80, upon detecting the occurrence of a paper jam, shut off drive control circuits 82 and paper jam indicator circuits 84. When the jam has been cleared, the operator actuates start circuits 86 to recommence operations.

The number of copies to be made are set by the operator at a copy selector switch 88, and this data is transferred into a copy downcounter 90, which receives count signals from the exit pocket switch 68, and determines whether and when the desired number of correct copies have been made. The downcounter 90 circuits also receive signals from the paper feed switch 60 to control feeding of the proper number of documents from the paper bin 54.

The operator can also select the mode of operation for mode control circuits 92, which subsequently provide actuation signals to the gate controls 94 and diverter controls 96, in sequences depending upon the mode selected (e.g. simplex only, simplex/duplex or duplex/duplex). The gate controls 94 and diverter controls 96 are conventional and detailed descriptions thereof are omitted for simplicity. The drive control circuits 82 also are straightforward, but have additional inputs from start circuits 86, the jam detection circuit 80 and any paper position sensors, such as the sensor 30. Clearly, all such functions could be controlled by a microprocessor programmed to provide the sequencing of master documents through the transport system 10 in accordance with the mode desired. However, the functions performed are not complex, and separate circuits may advantageously be used, as shown.

It will be evident to those skilled in the art, referring to Fig. 1 and Fig. 3, that this document handler configuration permits a wide variety of mode options and master document handling possibilities. As a first example, consider the mode in which simplex original documents are to be copied to provide a selected multiple number of duplex copy documents. With a semiautomic document feed system, as shown herein, an operator has a stack of documents at the entry tray 26 that are to be copied in pairs, using both sides of the copy document. When fed in, the first master moves past the entry gate 27 and under the transport belt 28 to be positioned against the exit gate 34 and thus held at the imaging station. The imaging system 12 thus transfers the image of the original to the drum 20, as copy documents are fed successively from the paper bin 54 to the image transfer station adjacent

the drum 20. As a series of illuminated images are projected and copy documents are fed past the image transfer station, the images are electrophotographically reproduced and fixed, then directed into the duplex storage bin 56. As soon as the last image from the first original document has been produced, this document is moved by the transport belt 29 from the lower run adjacent the document glass and reversed by the exit diverter 38 to the upper run, where it is held at the storage gate 36. Concurrently, a second original document is delivered into position at the imaging station. This action may be undertaken as soon as the last image illumination has been effected, when the last copy is in the process of being made. The step of moving a new document onto the glass can thus be carried out concurrently with other steps and thus no added delay is introduced.

At the duplex storage bin 56, which is used when duplex copies are being made, the copy documents with reproductions on one side (referred to herein as the obverse) are temporarily stored with the reproduced image up (in this example). These documents are then fed out from the duplex storage bin 56 back into the flow path to the image transfer station for receiving the second image on the reverse side. Because of the reversal of direction in moving from the duplex storage bin 56, the leading edge becomes the trailing edge, and because of the path followed through the copy document transport mechanism 14 the under side of the copy document now receives the image of the second master. After passing the image transfer station these copies are now diverted to the exit pocket 58. When the desired number of drum images has been counted at the drum image count switch 63, the original document is no longer needed at the imaging station for

reproduction purposes if no paper jam occurs. The document for the second page can be held at the image station until all copies have been received at the exit pocket 58, as detected by completion of the desired count by the copy downcounter 90 of copy documents moving to the exit pocket switch 68. In order to collect the sheets in the exit tray 40 in the same order as originally supplied, as well as to save time the transport belt 28 or other document transport device is operated with both original documents first being recirculated to the next succeeding run - i.e. with the exit diverter 38 and the entry diverter 44 causing turnaround of the documents at each end of the transport belt. Then, with the first original returned to the imaging station and the second original being at the storage station, the transport belt 28 can be stoppped until a signal is received from the copy down-counter 90. If the signal is received earlier the transport mechanism is kept operating, but with the exit diverter 38 switched to eject the first original and then the second original onto the exit tray 40. This action requires approximately 500 milliseconds, but can be shortened to less than half that time if an inverted pair sequence (e.g. 2, 1, 4, 3, etc.) is permissible at the exit tray. In the event that a jam occurs in this simplex/duplex mode of operation, both originals remain available for making the correct number of proper copies without further action by the operator except for the necessary extraction of the jammed paper. The various conditions that can arise are treated in detail below.

Fig. 2 is a flow diagram in which the rectangles represent possible successive functional steps or movements of the original document, while the diamonds (in dotted lines) represent events that must transpire in the copying system for successive movements

of the original to take place. Examination of this flow chart relative to the system organization of Fig. 1 enables understanding of the sequences undertaken under various modes of operation, as well as actions taken during malfunctions in those modes. The following modes and conditions encompass the principal variations of interest. Reference should concurrently be made to the system arrangement of Fig. 1 from which the physical flow of documents can be visualized.

SADF Jam - The semiautomatic document feed system, comprising the master document transport system 10 and associated circuits, may detect that the original document has not been successfully aligned or fed onto the document glass 18. The pre-entry sensor 30 usually identifies such a condition. Inasmuch as proper positioning of the original is a precondition to subsequent copying operations, the following sequence occurs when each new original is to be imaged (referring particularly to the functional steps [rectangles] of Fig. 2):

A. Copy Count Selector - the operator selects, at the switch 88, the number of copies to be made.

B. Down Counter - the downcounter 90 is set automatically according to the copy count selected.

C. Alignment - the operator places the original under sensor 30 which commands roller 26 to align the original against gate 27.

D. Fed Onto Glass - the transport system 10 moves the original onto the document glass.

At this point, a SADF jam may occur, in that the document may not be properly positioned. In this even a corrective sequence is undertaken as follows:

E. SADF Jam - the operator clears the jam by removing the document from the glass 18 and refeeding the document, or positioning the document manually. Thus the sequence returns to the Alginment step, with the condition (dotted line diamond) being satisfied as to "Exit Pocket Down Count Not Complete" because no copy documents have reached the exit pocket sensor switch 68 which controls the final downcounting.

Once the document is in proper position, image transfer is to then be effected:

F. Document Imaged - the document is held at the image transfer station until the "Drum Down Count Complete" condition is satisfied, which means that the drum image count switch 63 has activated the copy downcounter 90 to indicate that the last copy needed has left the image transfer position at the drum 20.

G. Document Exited - when "Drum Down Count Complete" exists, the document is fed out from the document glass 18. It can be recirculated or placed in an exit tray, as described hereafter.

Simplex Original/Simplex Copy Mode - After document imaging and exiting as described above, if no jams occur and only a simplex copy is to be made from a simplex original, the original is then:

H. Exited to Exit Tray - the document is not diverted upwardly to the storage station but the diverter 38 permits the document to pass to the exit tray 40.

Simplex Original/Duplex Copy Mode - (No jams - alternate exit tray) A straightforward sequence is followed if no jams occur in the copy document path for making copies on both sides of a copy document from two different originals. This mode is based upon the use of an alternate exit tray 100 on the same side of the document transport system 10 as the entry tray 24, as shown in Fig. 4. This arrangement has two primary advantages, in that (1) simplex originals need not be recirculated onto the document glass 18 when no copy jam occurs, and (2) duplex originals can be delivered in the same sequence as entered without an added passage through the recirculation loop. With the alternate exit tray 100 being used, the copy document path is set (Fig. 1) so that after an image is fixed on one side of each copy document it is sent to the duplex storage bin 56, and again returned, inverted, to the drum 20 position for receiving the image of the next original on the reverse side. The sequence is as follows, for the document, after it has been fed and imaged via the C, D, F, and G steps (Fig. 2):

I. Exited to Storage Area - the first original is shifted from the image transfer station to the storage station on the upper run of the transport belt 28.

J. Stored upon Drum Down Count Complete on Document Being Imaged - as the first original is held in storage the second is placed in image transfer position for the preparation of the needed duplex copies.

K. Exited from Storage - the storage gate 36 is opened to permit the documents to transfer out.

L. Exited Pocket Down Count Complete on Document Being Imaged - when the exit pocket switch 68 has indicated delivery of the needed copies to the downcounter 90, the originals are no longer needed and can be transported out.

M. To Alternate Exit Tray - the diverter 44 is positioned, and the belt 28 is driven, so that the originals are delivered to the alternate exit tray 100.

Simplex Originals/Duplex Copy (No Jams - Standard Exit Tray) - With the standard exit tray 40 (Figs. 1 and 3) in use, the recirculation loop can be used in one of two ways, although the original proceeds from the document glass 18 to the storage station and then can be exited in the C, D, F, G, I, K, L sequence previously described. However, when the exit pocket downcount is complete, the second document is at the image transfer station, closer to the exit tray 40. Thus the faster way to exit the two documents is to open the exit gate 34 and shift the exit diverter 38 so that the following sequence occurs:

Second Original - proceeds directly through the D, G, H sequence to the exit tray 40.

First Original - on being exited from storage (K, L) returns (D) to the galss 18 at the image transfer station and then moved through the D, G, H sequence to the tray 40.

The immediately above sequences result in reversed pairs (e.g. 2, 1, 4, 3, 6, 5, etc.) at the exit tray 40. If this is not acceptable, then the proper order can be established by use of an additional half-revolution of the recirculation loop, at the cost of the time delay involved. For this purpose the diverter 38 first causes turnaround of the second original to the storage station, while the first original is returned back to the image transfer station. Thereafter the first and second originals can be exited serially as above described.

Duplex Original/Simplex Copy (No Jams) - A document having images on both sides is run through the recirculation loop twice, the second time inverted and with the former leading edge becoming the trailing edge. The A, B, C, D, F, G, I sequence is followed in delivering the original to the storage station after imaging. The original is not held at the storage station but returned to the entry tray 24:

N. Pass Through for Duplex - the diverter 44 is positioned so that when the document passes the storage gate 36 it goes directly out to the tray 24, in which location it has the desired inverted and edge-

reversed position. It may be fed again automatically as by an element (not shown) which impels the leading edge into the feed mechanism. Alternatively the operator may simply realign (C) and feed the original back through the D, F, G, H sequence in which it ends in the exit tray 40.

Simplex Original/Duplex Copy (Paper Path Jam During Imaging of 1st or 2nd Master) - A copy paper jam during imaging of a first simplex original used in making duplex copies requires corrective action based only on that original alone. If the jam occurs before the final exposure of the first simplex original, that document is simply held at the image station. Thus after the jam is cleared, image transfer for the first side of the duplex copy can be carried out until the desired number of copies are in the duplex bin. If the first simplex original has been imaged the desired number of times but a jam occurs during runout of the copies, a different procedure is followed because the second simplex original is made available at the image station during the runout interval. Therefore the second simplex original is imaged until the duplex bin is emptied. The needed corrective number of copies can then be made by returning the first original to the image station, sending the needed number of copies to the duplex bin, and then placing the second duplex original at the image station and copying on the reverse side. Alternatively, because some collators have a turnaround device (or a turnaround device can be added) the copies of the reverse side may be made first, drawing paper from the feed bin instead of the duplex bin. The first original can then be returned to the image station, the obverse copies added, and each document turned around in the collator or before reaching the exit tray.

A jam during imaging of a second original also requires re-imaging, in a variable amount dependent upon the number of copies lost, of both the simplex originals, and this will be described in more detail. The sequences are conveniently subdivided into pre-jam, jam and post-jam intervals. In the time span prior to the jam, the first original is imaged and then stored, in the A, B, C, D, F, G, I, J sequence. After imaging of the first original the second original goes into the C, D, F sequence. With the second original on the document glass 18 it is assumed that some arbitrary number of copies have been made when a jam occurs. At this point in time the "jam" condition is indicated at the same time "Drum Down Count Not Complete" exists, although the operator may be provided with an indication of the number of (duplex) copies delivered to the exit pocket.

Jam in copy documents - The occurrence of a jam with some duplex copies safely in the exit pocket 58 and an indeterminate number of copies in the paper path prior to the jam, or in the duplex storage bin 56, first requires clearance of the jam. It is assumed that the "Drum Down Count Not Complete" condition exists, although even if all copies had been made some might have been rendered unusable by the jam condition. Then the operator corrects the sequence, as follows:

0. Path Jam Cleared, Downcounter Adjusted Automatically - the paper in the system path (i.e. those copies not in the duplex bin or exit pocket) is extracted as the jam is cleared. Salvage of imcomplete copies requires excessive handling and computation time as well as introducing unwanted complexity into

the clearance procedure. The downcounter automatically establishes the number of replenishment copies needed to complete the desired total. This quantity may be established, either immediately upon jam clearance if the number of copies in the duplex bin or exit pocket have been counted, or later when an inadequate number of copies have reached the exit pocket. The operator may also reset the downcounter to a new number to give the desired final total.

P. Machine Start Button Pushed - restarting of the copier in this mode, with the two simplex originals at different positions, undertakes the post-jam sequence for duplex copies of simplex originals.

Post-Jam Sequence - Imaging of the second simplex original is recommenced and continued until the duplex bin is emptied unless there were no copies remaining in the duplex bin. Then the first simplex original is recirculated back to the image station from the storage phase (J), first being exited from storage (K). Concurrently, the second simplex original is exited (G) to the storage station (I, J) from the imaging phase (F), although the drum downcount is not complete. Thus the copying can recommence with the first simplex original at the image transfer station and the second simplex original at the storage station. Alternatively, with a turnaround device in the copy document handler, the procedure of keeping the second simplex original at the image station and copying the reverse side of copy documents from the paper bin first, followed by copying of the obverse and subsequent turnaround, can be utilized at this time.

When the first simplex original has been imaged the desired number of times for the "Drum Down Count Complete" condition, it again is moved to storage (I, J), and held while the second simplex original is returned to the image transfer position (K, L, D). When the second simplex original has been imaged the desired adjusted number of times and the "Exit Pocket Down Count Complete" condition met, the two simplex originals are exited, with the first simplex original being fed out first (K, L, D, G, H) while the second simplex original is returned past the storage station (G, I, J) before following the same exiting sequence (K, L, D, G, H).

Duplex Original/Duplex Copy (Jam on Imaging of Second Master)- As in the example above, a copy document jam after completion of imaging of the first side of a duplex original or during imaging of the second side of a duplex original introduces more complex problems than if the jam occurs prior to completion of imaging the first side. The more difficult procedure is thus described hereafter, it being assumed that the first duplex original side has been fed, copied and returned for completion of duplexing to the entry side via the sequence A, B, C, D, F, G, I, N and back for alignment at C. The second duplex original side can then be advanced to imaging (C, D, F), at which point a jam is assumed to occur in the copy document path. The jam procedure is then as previously described (phases O and P), with discard of waste and incomplete copies. When the copier restarts, the copying of the second side of original is carried out until the duplex bin is emptied. The original is then returned (G, I, N) and is received by the operator in the original (first side) position to enable the subsequent automatic completion of the run to make up the loss in the jam.

Assuming that no further jams occur, the original is again passed twice into the machine in the sequence C, D, F, G, I, N, being returned to the entry tray 24 both times. After all copies are made the operator can simply transfer the original from the entry tray to the exit tray. Alternatively, the original can be fed through one final time in a "No Copy" mode to pass directly across the document glass to the exit tray in a sequence C, D, G, H. The imaging step is bypassed because the "Exit Pocket Down Count Complete" condition is satisfied.

SADF Jam (Exit Pocket Down Count Complete) - In the event that a master document jam arises but copies have been made correctly, the operator need only remove the original and place it in the exit tray 40, as shown by phase D.

Fig. 4 shows an embodiment of the original document transport system in which the exit tray 100 is positioned on the same side as the entry tray 24. Apart from this difference, the only other difference between the Fig. 1 and Fig. 4 systems is that in the Fig. 4 system, diverter 38 is fixed and only diverter 44 is movable to select the document path. With the Fig. 4 system, the operations described with reference to Fig. 2 are identical except that in order to eject a document, diverter 44 is set to the position as shown so that the document passes directly from the storage section to the exit tray.

CLAIMS

1. An original document transport mechanism for an electrophotographic copier comprising means (28, 29) for transporting original documents round a closed path through an imaging station (18) which includes gating means (34) movable into the path to locate a document in position for imaging, an entry tray (24) arranged to receive documents to be transported and to direct them into the path, a first diverter device (38) movable between a position adjacent the path to maintain documents in the path and a position intercepting the path to divert documents therefrom towards an exit tray (40), characterised in that said path passes through a storage station into which documents in the path pass in face-inverted orientation with respect to their orientation at the imaging station, said storage station including gating means (36) movable into the path to locate a document therein at a fixed storage position.

2. An original document transport mechanism as claimed in claim 1 in which the transporting means comprises a belt drive system defining two straight parallel runs, characterised in that the imaging and storage stations are positioned at respective ones of the runs.

3. An original document transport mechanism as claimed in claim 2 characterised in that the first diverter device, when in the adjacent position, is arranged to direct documents in a curve between a first adjacent end of both runs.

4. An original document transport mechanism as claimed in claim 3 further characterised by a second diverter device (44) positioned adjacent the path to direct documents in a curve between a second adjacent end of both runs opposite said first adjacent end.

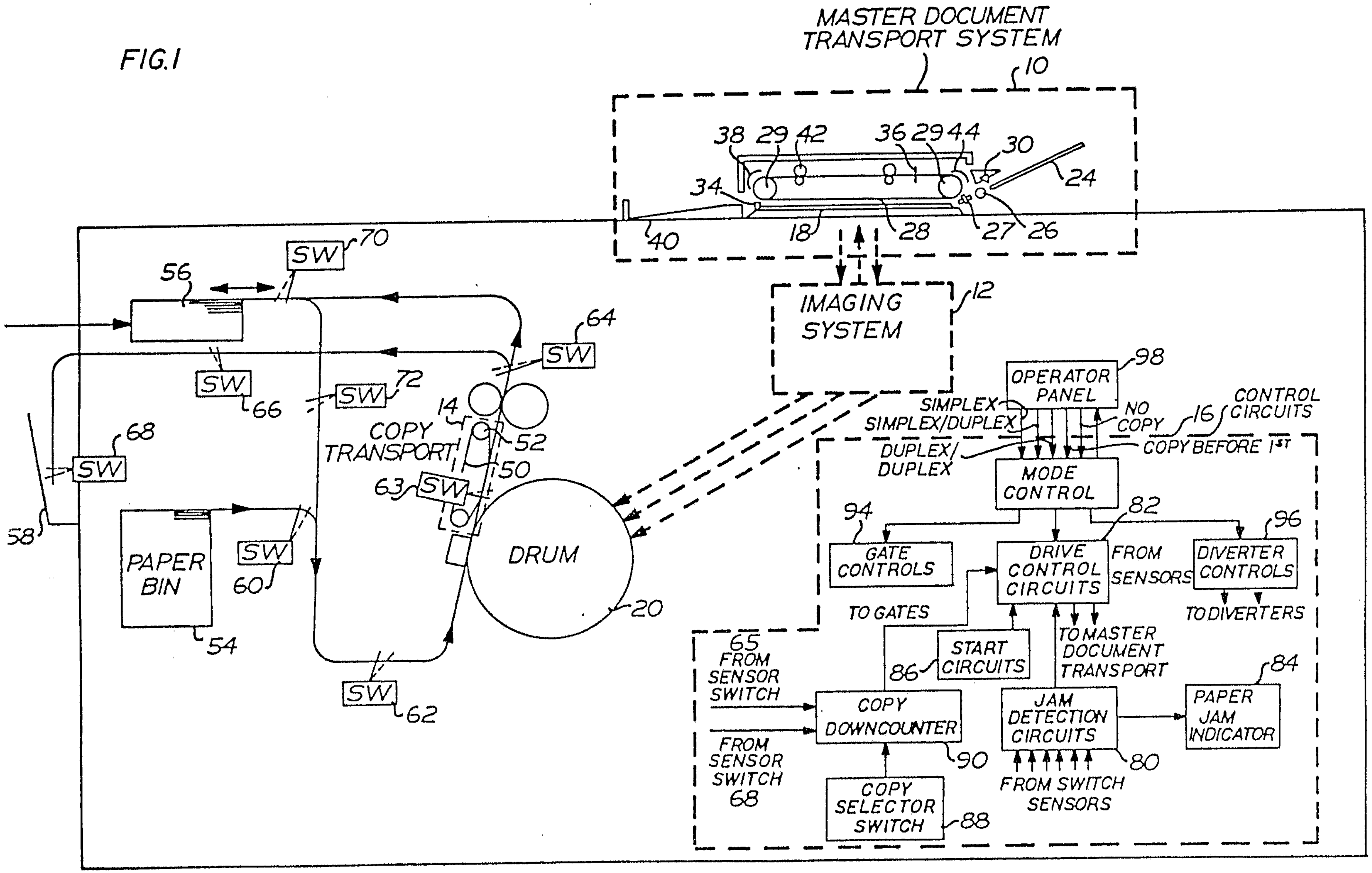
5. An original document transport mechanism as claimed in claim 4 further characterised in that said second diverter device is movable between its position adjacent the path and a position intercepting the path to divert documents therefrom towards the entry tray.

6. An original document transport mechanism as claimed in claim 5 further characterised in that said entry tray and second diverter device are located, with respect to a fixed direction of movement of documents round the path, at a position subsequent to the storage station and before the imaging station and the first diverter device and exit tray are located at a position subsequent to the imaging station and before the storage station.

7. An original document transport mechanism as claimed in claim 4 characterised in that said entry tray, said exit tray and said first diverter device are located adjacent said first adjacent end of both runs.

8. An original document transport mechanism as claimed in any of the previous claims further characterised by control means coupled to control the gating means and the, or each, diverter device such that a document is held at the storage station whilst a subsequently fed document is held at the imaging station.

FIG.1


MASTER DOCUMENT TRANSPORT SYSTEM
10
38 29 42 36 29 44 30 24
34 40 18 28 27 26
IMAGING SYSTEM
12
SW 70
56
SW 64
SW 66
SW 72
14
COPY TRANSPORT
52
50
63 SW
SW 68
58
PAPER BIN
54
SW 60
SW 62
DRUM
20
OPERATOR PANEL
98
SIMPLEX
SIMPLEX/DUPLEX
DUPLEX/DUPLEX
NO COPY
COPY BEFORE 1ST
16
CONTROL CIRCUITS
MODE CONTROL
82
94
GATE CONTROLS
TO GATES
DRIVE CONTROL CIRCUITS
FROM SENSORS
DIVERTER CONTROLS
96
TO DIVERTERS
START CIRCUITS
86
TO MASTER DOCUMENT TRANSPORT
65 FROM SENSOR SWITCH
FROM SENSOR SWITCH 68
COPY DOWNCOUNTER
90
JAM DETECTION CIRCUITS
80
FROM SWITCH SENSORS
PAPER JAM INDICATOR
84
COPY SELECTOR SWITCH
88

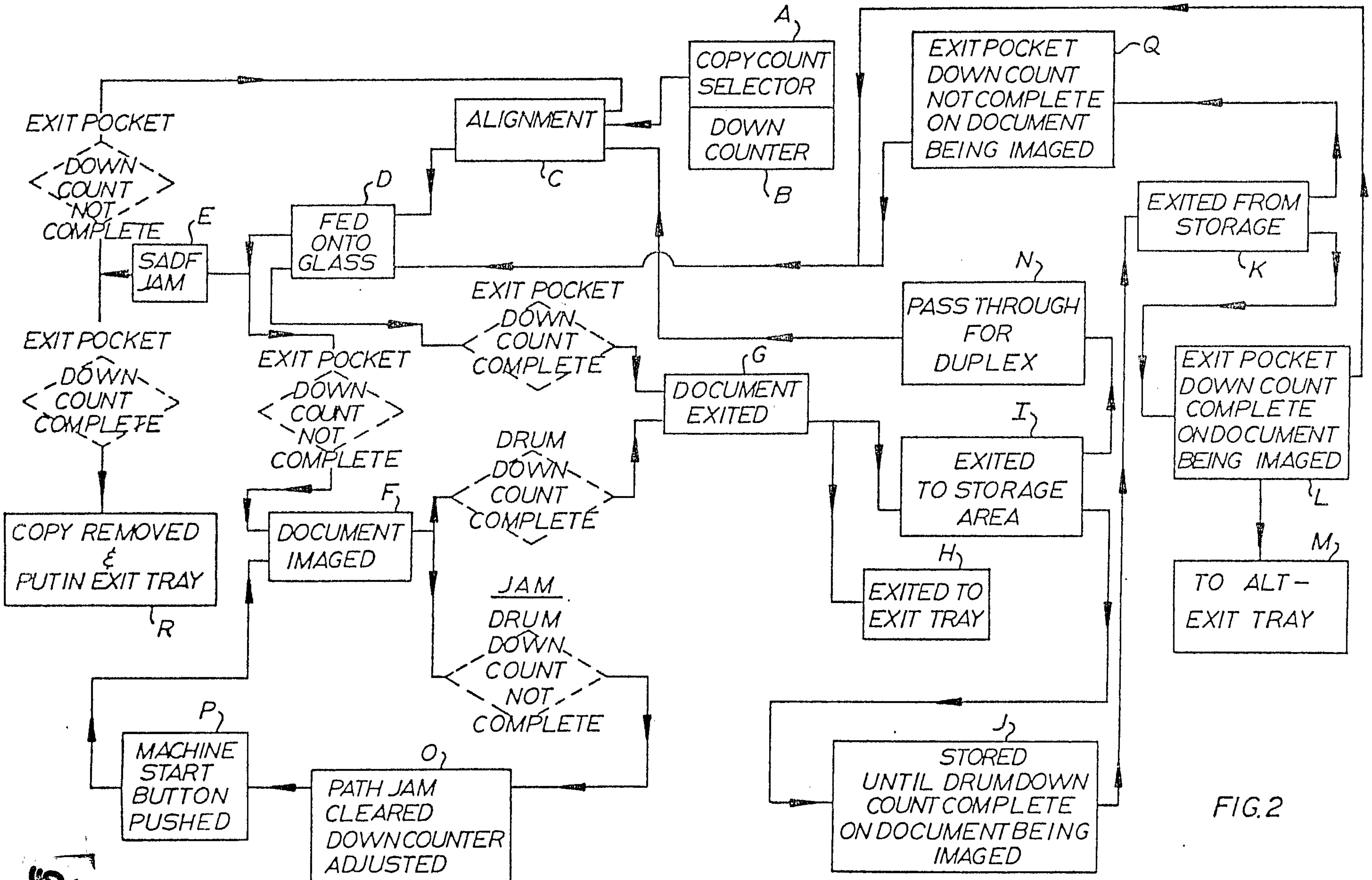

COPY COUNT SELECTOR
A
DOWN COUNTER
B
ALIGNMENT
C
FED ONTO GLASS
D
SADF JAM
E
DOCUMENT IMAGED
F
DOCUMENT EXITED
G
EXITED TO EXIT TRAY
H
EXITED TO STORAGE AREA
I
STORED UNTIL DRUM DOWN COUNT COMPLETE ON DOCUMENT BEING IMAGED
J
EXITED FROM STORAGE
K
EXIT POCKET DOWN COUNT COMPLETE ON DOCUMENT BEING IMAGED
L
TO ALT-EXIT TRAY
M
PASS THROUGH FOR DUPLEX
N
PATH JAM CLEARED DOWN COUNTER ADJUSTED
O
MACHINE START BUTTON PUSHED
P
EXIT POCKET DOWN COUNT NOT COMPLETE ON DOCUMENT BEING IMAGED
Q
COPY REMOVED & PUT IN EXIT TRAY
R
EXIT POCKET DOWN COUNT NOT COMPLETE
EXIT POCKET DOWN COUNT COMPLETE
EXIT POCKET DOWN COUNT NOT COMPLETE
EXIT POCKET DOWN COUNT COMPLETE
DRUM DOWN COUNT COMPLETE
JAM
DRUM DOWN COUNT NOT COMPLETE

FIG.2

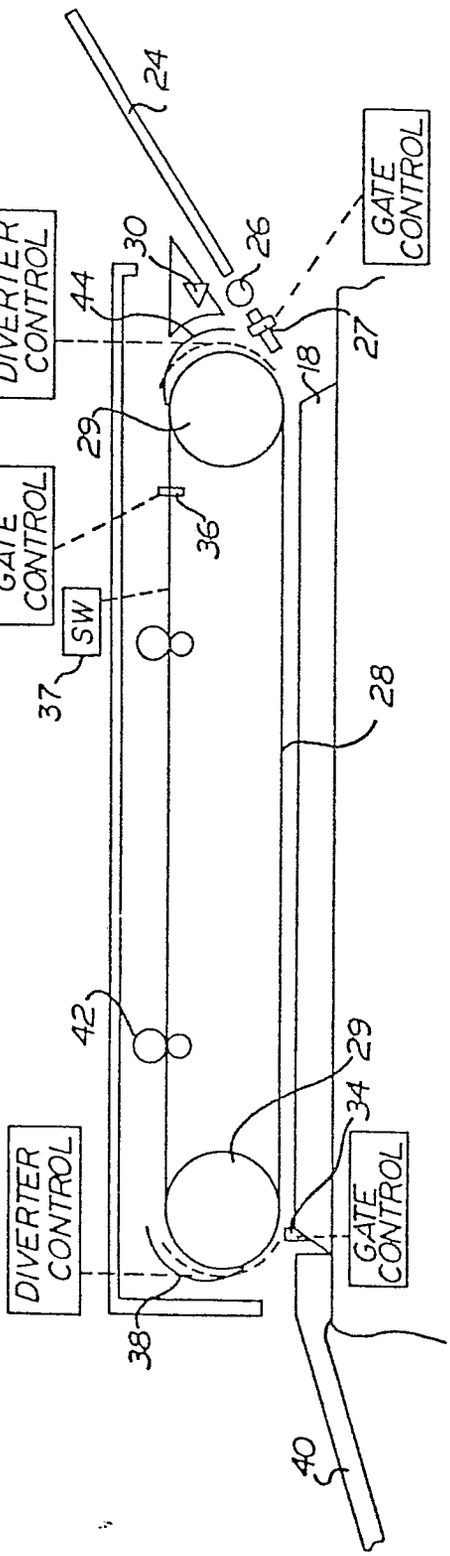

24
DIVERTER CONTROL
30
44
26
GATE CONTROL
27
18
29
GATE CONTROL
SW
36
37
28
42
29
34
DIVERTER CONTROL
GATE CONTROL
38
40

FIG.3

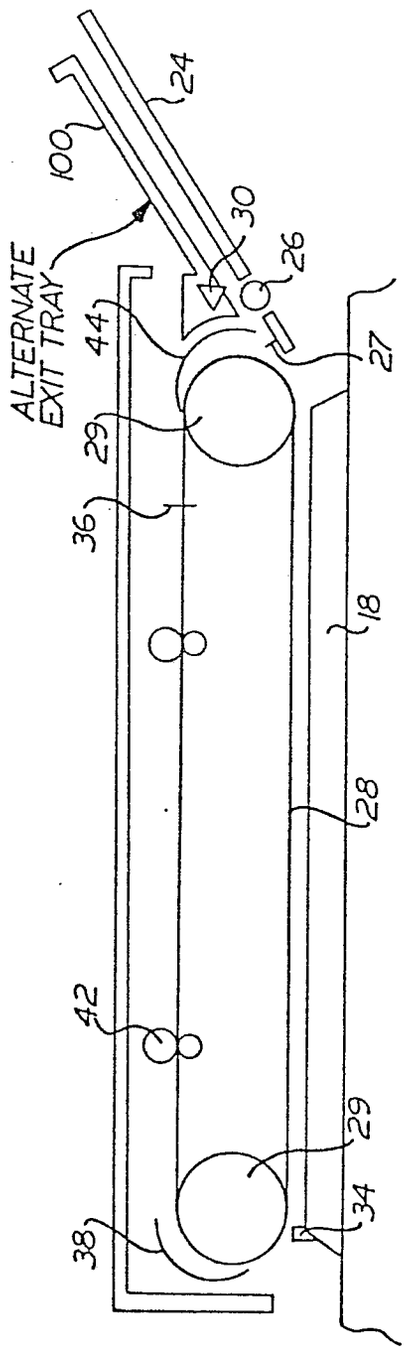

100
24
ALTERNATE EXIT TRAY
30
26
44
27
29
36
18
28
42
29
34
38

FIG.4

European Patent Office

EUROPEAN SEARCH REPORT

Application number
EP 80102085.0

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	DE - A - 1 597 724 (PITNEY-BOWES) + Fig. 1; pages 5,6 + --	1,3-5, 6,7,8
	DE - B - 1 128 295 (RANKERS) + Fig. + --	1,2,6
	FR - A - 2 366 203 (IBM) + Fig. 1-12 + --	1,3
X	GB - A - 1 267 306 (KABUSHIKI KAISHA RICOH) + Fig. 2; page 3, lines 72-81 + --	8
	US - A - 4 068 839 (BULLOCK) + Fig. 1 + --	1,3-5, 6,7,8
X	US - A - 4 027 870 (FRECH) + Fig. 1-3 + --	1,2
	US - A - 3 416 863 (RAISTON) + Fig. 1,2 + --	1,2,3,5
	GB - A - 1 487 954 (XEROX) + Fig. 1-4; page 3, lines 30-54, lines 76-85 + ----	2

CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)

G 03 G 21/00
B 65 H 25/00
G 03 B 27/46

TECHNICAL FIELDS SEARCHED (Int.Cl. ³)

G 03 B 27/00
B 65 H 29/00
B 65 H 33/00
G 03 G 15/00
G 03 G 21/00

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

X The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	12-08-1980	KRAL

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